Bay Species

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Annual abundance indices for the shrimp *Crangon franciscorum*, Dungeness crab, and 11 common bay fishes are presented in this article. *Crangon franciscorum*, starry flounder, and yellowfin goby rear in areas with oligohaline (0.5-5‰) and mesohaline (5-18‰) salinities, though some starry flounder and yellowfin goby juveniles rear in freshwater for at least a portion of their first year. The remaining species primarily rear in areas with polyhaline (18-30‰) salinities. All of these species spawn in the lower portions of the bay or in the nearshore ocean area and immigrate to the bay as older larvae or juveniles. Three events were important in determining abundance and distribution of species in the bay in 1997: the extremely high outflows associated with the January 1997 flood, the relatively low outflows and increasing salinities during spring and summer, and above average ocean temperatures associated the strong El Niño.

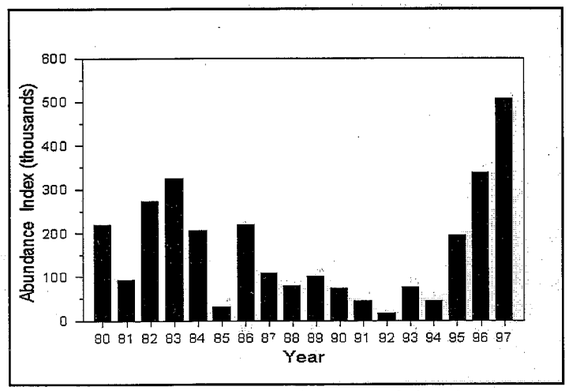

Figure 1. Annual Abundance of Immature *C. franciscorum*, May-October Otter Trawl

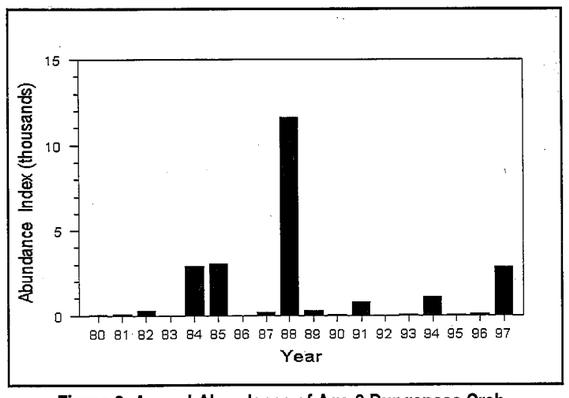

Figure 2. Annual Abundance of Age-0 Dungeness Crab, May-July Otter Trawl

Abundance of immature *C. franciscorum* was the highest for the study period in 1997 (Figure 1) and was higher than predicted based on the previous relationship between abundance and outflow. We hypothesize that the large number of immature *C. franciscorum* in 1996 resulted in large 1997 brood stock population and that brood stock, in conjunction with outflow, was an important factor in determining recruitment of immature shrimp in 1997. The relationship between brood stock and recruitment of *C. franciscorum* is being investigated further.

In 1997, the abundance of age-0 Dungeness crab was the highest since 1988 (Figure 2). Ocean currents and temperature in winter 1997 were favorable for retention and survival of Dungeness crab larvae, resulting in a relatively strong year class in the bay. Distribution of age-0 Dungeness crabs was centered in San Pablo Bay, the lower Napa River, and lower Suisun Bay in 1997.

The 1997 abundance index of northern anchovy, one of the most important forage species in the bay, was similar in magnitude to 1995 and 1996 indices (Figure 3). Northern anchovy found in the bay are part of the Central California subpopulation, which moves northward along the coast when ocean temperatures increase. By fall 1997, our northern anchovy catches were very low, reflecting a regional decline in abundance attributed to the El Niño event.

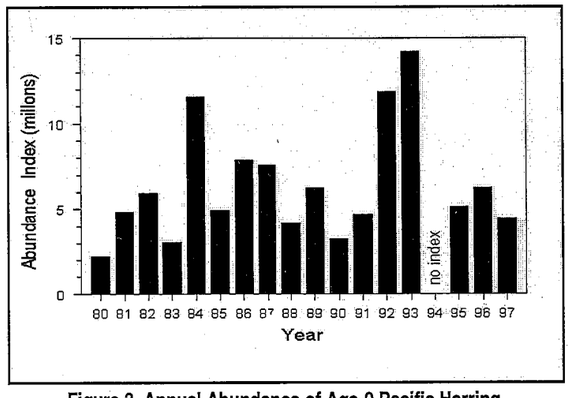

Figure 3. Annual Abundance of Age-0 Pacific Herring, April-September Midwater Trawl

Abundance of age-0 Pacific herring only slightly increased in 1997 (Figure 4), in spite of near record high spawning biomass the winter of 1996-1997. As a result of extremely high outflow and decreased salinities in Central Bay in January 1997, Pacific herring delayed spawning for several weeks. By the time salinities were suitable for spawning, some females had reabsorbed their eggs (D. Watters, CDFG, pers. comm.)

Abundance of age-0 jacksmelt was again relatively low in 1997, continuing the trend of low indices for the past decade (Figure 5). Jacksmelt rear in very shallow areas of the bay through their first summer and most emigrate to the ocean by winter. They are an important forage species, especially for terns and other diving birds in South Bay.

White croaker abundance was very low in 1997, continuing a trend of decreasing abundance since 1993 (Figure 6). Age-0 abundance was the lowest since 1980 and total abundance was the lowest on record.

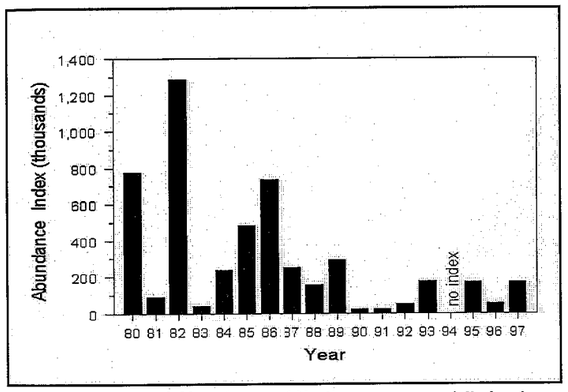

Figure 4. Annual Abundance of Northern Anchovy (all sizes), April-October Midwater Trawl

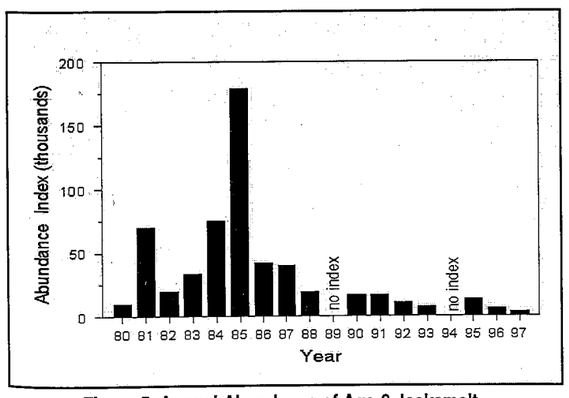

Figure 5. Annual Abundance of Age-0 Jacksmelt, July-October Midwater Trawl

Bay goby abundance declined slightly in 1997 from 1996, but the trend of relatively high indices in recent years continued (Figure 7). The bay goby is an important forage species common to South, Central, and San Pablo bays.

In 1997, abundance of the introduced yellowfin goby, which is common in areas upstream of San Pablo Bay, was low (Figure 8). Abundance of this species has been highly variable relative to outflow. Although the highest indices have been in years with high outflow (e.g., 1986, 1993, 1995), not all years with high outflow had high abundance.

Abundance of age-0 staghorn sculpin declined in 1997, but the index was near average for the study period (Figure 9). There has been a general trend of increased abundance with increased outflow - the major exceptions have been in 1983, a high outflow year when abundance declined, and 1989 a low outflow year when abundance

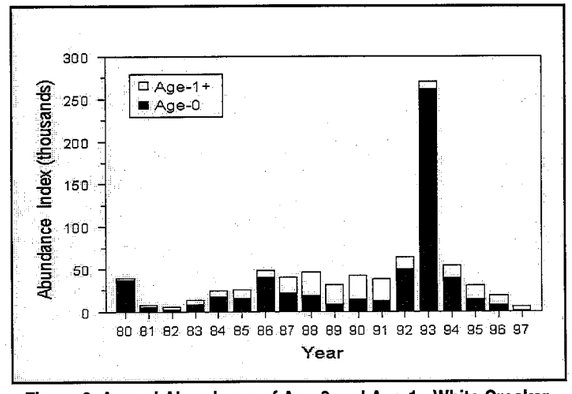

Figure 6. Annual Abundance of Age-0 and Age-1+ White Croaker, February-October Otter Trawl

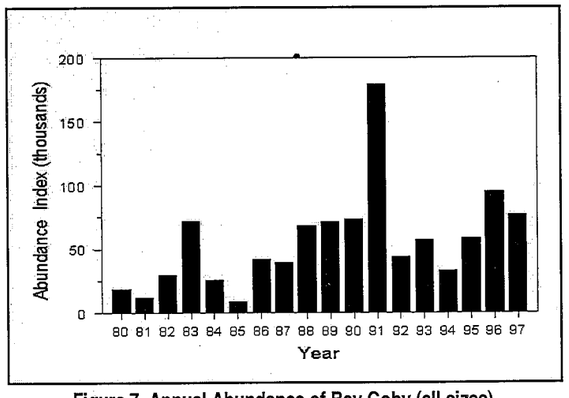

Figure 7. Annual Abundance of Bay Goby (all sizes), February-October Otter Trawl

increased. Staghorn sculpin rear in shallow areas with mesohaline and polyhaline salinities, moving to higher salinities with age. In 1997, distribution was centered in San Pablo and Suisun bays in the spring, with a gradual movement downstream through the summer.

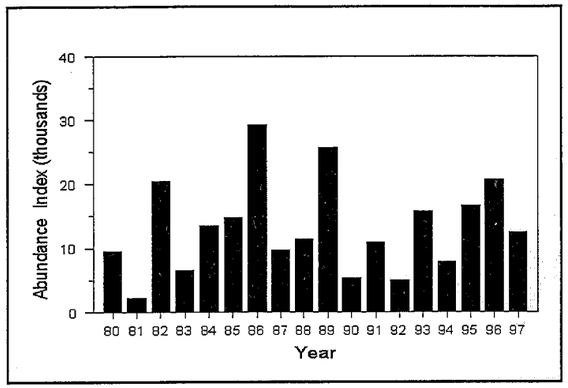

Figure 8. Annual Abundance of Age-0 Yellowfin Goby, gMay-October Otter Trawl

In 1997, abundance of California halibut continued to decline (Figure 10). Several strong year classes in the early 1990s resulted in the 1993-1994 abundance peak. Due to sporadic local recruitment and their use of very shallow (<2 m) water, we rarely collect age-0 California halibut in the otter trawl. In November and December 1997, 7 age-0 California halibut were collected, suggesting local recruitment and increased abundance for 1998 and beyond.

After 3 years of low indices, abundance of age-0 English sole increased in 1997 (Figure 11). Although abundance indices have been somewhat cyclic, factors controlling recruitment of English sole to the bay are not well understood. Distribution of age-0 English sole is usually centered in San Pablo Bay; in 1997, they were widely distributed from South through San Pablo bays until late summer.

Abundance of speckled sanddab increased in 1997, continuing the trend of relatively high indices since 1993 (Figure 12). In recent years, speckled sanddab has been the most abundant species of flatfish in the Bay. In 1997, it was also widely distributed from South to San Pablo bays through late summer.

Although the abundance index of age-0 starry flounder increased slightly in 1997 (Figure 13a), there is strong evidence that the starry flounder population in the bay has declined substantially since the 1960s and 1970s. The 1997 index of age-1 starry flounder (the 1996 year class) also increased slightly (Figure 13b). In 1997, age-0 fish were distributed from San Pablo Bay to freshwater in the lower Sacramento and San Joaquin rivers while age-1 fish were concentrated in San Pablo and Suisun bays. Starry flounder rear in the Bay for 3 to 4 years, inhabiting shallow (<6 m) water and moving to higher salinities with age.

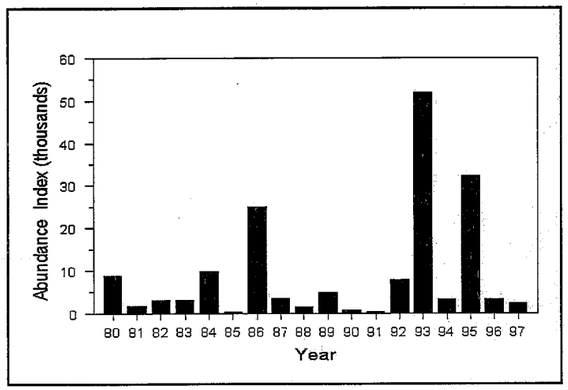

Figure 9. Annual Abundance of Age-0 Staghorn Sculpin, February-September Otter Trawl

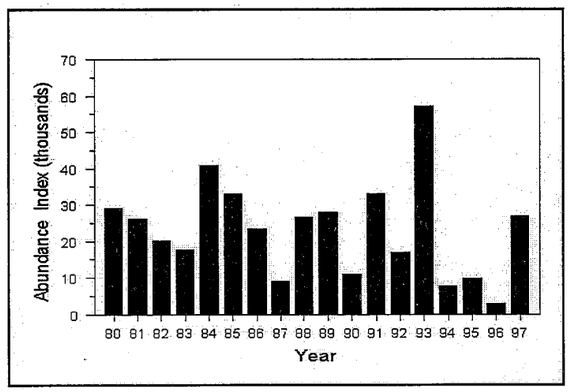

Figure11. Annual Abundance of Age-0 English Sole, February-October Otter Trawl

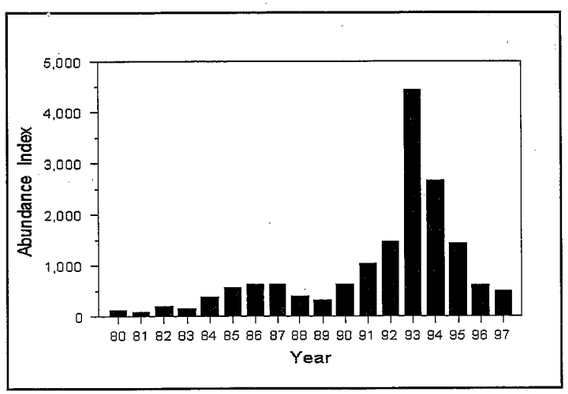

Figure 10. Annual Abundance of California Halibut (all sizes), February-October Otter Trawl

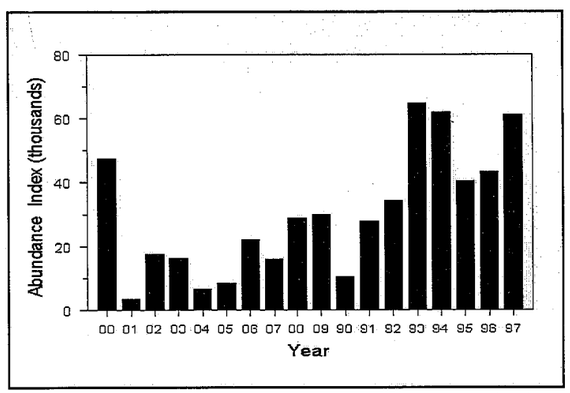

Figure 12. Annual Abundance of Speckled Sandab (all sizes) February-OctobeR Otter Trawl

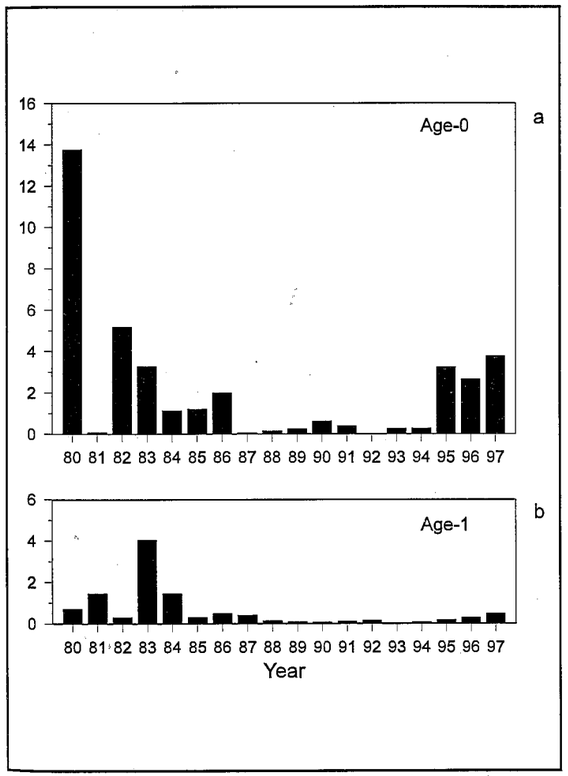

Figure 13. Annual Abundance of Starry Flounder, Otter Trawl:
a. Age-0, May-October
b. Age-1, February-October

Chinook Salmon

Randall Brown, Erin Chappell, and Sheila Greene, DWR

Figures 1 through 11 contain plots of information related to 1997 chinook salmon catch and escapement. These data were obtained from:

- Pacific Fishery Management Council (February 1998). Review of 1997 Ocean Salmon Fishery.
- California Department of Fish and Game (December 1997). Status of Activities to Restore Spring-run Chinook Salmon - A special report to the California Fish and Game Commission.

Although the graphics are largely self-expanatory, the following comments may be helpful:

Figure 1. At more than one million fish, the 1997 ocean catch plus escapement was the third highest during the period of record.

Figure 2. Ocean landings, commercial plus recreational, were also the third highest for the period of record.

Figure 3. High ocean catches in 1997 were achieved even though the harvest index was significantly lower than had been during most of the past 10 years or so. The low harvest index was due to restrictions on the fishery to protect winter chinook, Klamath River fall chinook and Snake River fall chinook.

At about 400,000 estimated adult spawners, the Sacramento River fall-run ecapement (hatchery plus natural spawners) was the highest for the period of record. Note that:

- the estimate does not include an inland recreational harvest estimated at 25%;
- the regulatory Sacramento River fall chinook escapement goal is from 122,000 to 180,000 hatchery and natural spawners combined;
- the hatchery totals are those salmon actually taken into the hatchery, not salmon of hatchery origin that spawned naturally in the streams.

Figure 9. The estimates for upper Sacramento River spring chinook include spawners in Deer, Mill and Butte creeks. For comparison, the 1994 run at least replaced itself on Butte and Deer creeks but not on Mill Creek - i.e.: